Potential of Organic Farming to Mitigate Climate Change and Increase Small Farmers' Welfare

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2019

POTENTIAL OF ORGANIC FARMING TO MITIGATE CLIMATE CHANGE AND INCREASE SMALL FARMERS' WELFARE

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Abstract

Global climate change will have maximum damaging effects on the vulnerable population living in the global south, mainly the small farmers, traditional forest dwellers, and coastal communities. Small farms of less than 1 hectare, estimated to be around 410 million worldwide, are in areas of high poverty density. Any effort to achieve the "no poverty" goal of SDG and increasing their welfare will require a synergistic attempt on the part of climate change mitigation and adaptation, achieving sustainable livelihoods and improving health and nutrition indicators of these people. In this context, organic cultivation acquires particular importance due to its climate mitigation potential. It balances and corrects nutrient cycles, carbon sequestration and reduces carbon emissions from chemical farming. Its poverty reduction potential is due to a reduction in the input cost for the farmer, better prices in the market, improvement of health as contact with chemical fertilizers and pesticides reduces and nutrient-rich food consumption. Organic cultivation acquires particular relevance in the context of countries like India where a large number of farmers are small and marginal. They currently face adverse market conditions where the input cost of farming is higher than the prices at which the market values their produce. Organic cultivation can reduce this cost and increase the profitability of farming for them. This paper analyzes the available literature related to organic agriculture and its future potential for improving the welfare of Indian farmers most of which are small and marginal.

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Keywords: *Organic, Zero budget natural farming, Climate change, Small farmer*

1. Introduction

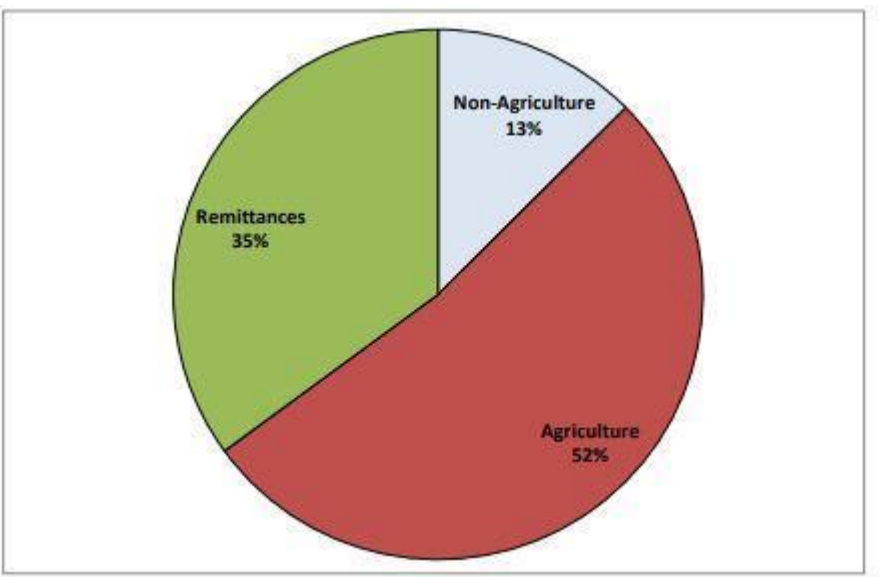
Poverty and chronic hunger have plagued the world since a long time International efforts towards decreasing the poverty levels across the globe have helped achieve some success on this front, though the absolute number of poor are still very high. According to FAO, the total numbers of undernourished and deprived people have increased from 804 million in 2016 to 821 million in 2017, and it affects the most in South America and Africa. The undernourishment rates which were experienced by Asia have also slowed down (FAO,2018). These statistics show a disturbing trend and pose to be a hurdle before the world can achieve the Sustainable Development Goals (SDG) 2030, of zero poverty and hunger; good health; clean water, sanitation and energy; and reduction in inequality (Griggs et al., 2013).

Figure 1. FAO (2017) Comparison of prevalence and number of undernourished people by region. Size of the circle represents the number of undernourished people in millions.

NOTE: Comparison of prevalence and number of undernourished people by region. The size of the circles represents the number of undernourished people in millions, as labelled. Figures for 2016 are projected values (see Box 1 on p. 4 and Methodological notes in Annex 1, p. 95).
SOURCE: FAO.

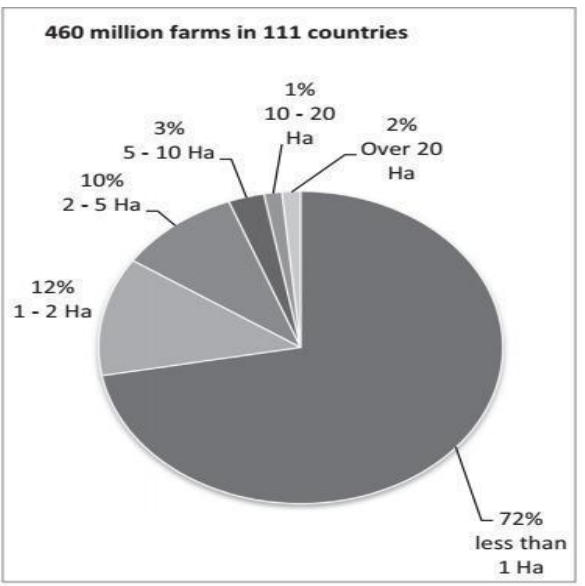
Evidences from the experience of different countries suggest that agriculture is a powerful, yet under-acknowledged strategy for reducing poverty among the poorest (for instance, those below $1 per day) (Christiaensen et al., 2011; Cervantes Godoy & Dewbre, 2010); and this can be attributed to more substantial participation of these households in agriculture operations, either on own farms or as hired labor.

Figure 2. Contribution of different sectors to poverty reduction (based on data from 25 developing countries) Source: OECD calculations based on data from Povcalnet, 2009 and WDI, 2009. Adapted from Cervantes Godoy & Dewbre, 2010



Most of the undernourished and poor people of the world live on small family operated farms and are subsistence farmers. Worldwide there are about 410 million of less than 1 hectare and 475 million farms below 2 hectares (Lowder et al., 2016) and these are in areas of high poverty density. These farmers are essential for ensuring food security in developing countries (Alteri, 2009). But, there has been an increased dependence of these farmers on markets for their food in the recent years and food expenditures may account for 60-80 percent of the overall household expenditures (Baiphethi & Jacobs, 2009).

Figure 3. Lowder et al. (2016). World distribution of farms according to the landholding sizes.



Some of the possible reasons have been the changes in the cropping patterns and farming systems post green revolution, more reliance of farmers on state agents for their needs of seeds and fertilizers, more inputs required per crop of HYVs; more needs of irrigation and groundwater depletion and lack of assured irrigation facilities, high input cost of farming etc.

During the 60s, the wave of green revolution increased the food production in the world working on the food availability approach, but it leads to resource concentration, increased inequality and depleted the fertility of the soil. The high use of chemical-based fertilizers, pesticides, weedicides and HYV seeds led to the degradation of natural resources, alteration in biotic cycles and environmental losses (Altieri, 2009). This technological shift was based on resource-rich large farmers who could afford to use the inputs required for cultivation, had access to timely credits and got the benefit of state-supported subsidies. The poor small farmers were overlooked in this new technological revolution (Pingali, 2012). Though in the long run, ground level reports suggest that these farmers were more resource efficient than large farmers.

In recent years, the change in rainfall patterns, frequent droughts, flash floods has pointed towards an increased shift in climate patterns. These climate pattern changes will have detrimental effects on agriculture, and the most vulnerable people will be the small farmers, coastal communities, and traditional tribal communities living in the forests, and depending on forests and marginal lands for their livelihood. In such a backdrop, organic agriculture blended with other conventional modes of cultivation, indigenous knowledge systems, culturally diverse food systems, have much hope to offer to feed the world population. Also, they provide innovative solutions to a shift towards climate resilience systems as they are ecologically more sustainable.

This paper argues in favor of a shift in policies towards organic agriculture for small farmers as a means for sustenance, food and nutrition security, decrease in poverty and as resilience to climate change. We will also discuss the opportunities and challenges that have to be dealt with before this shift can occur.

2. Organic Farming as an alternative solution to food security and climate change

Organic farming as a sustainable system of farming, has been proposed by many researchers (Scialabba et al., 2010; Pimentel, 2006; Nigli et al., 2008) as an alternative solution to the food security and climate change challenge that the world currently faces. This is due to the use of natural products/by-products into it as inputs for farming and hence the improvement in the ecosystem of the area. The food produced is found to be much healthier and nutritious and generates less carbon footprints on the planet. So it has been advocated as an environment friendly production practice by many researchers (Chappell and LaValle, 2011; Scialabba, 2010 ; Seufert et al., 2012).

3. Benefits of organic farming

3.1. Economic Benefits

Increasing awareness of the consumers to the harmful effects of chemically produced foods have increased the demand for organically produced foods, especially fruits and vegetables. Most of this customer base is in the

developed countries of Europe and the U.S. This opens up new opportunities for the farmers in the developing countries to cater to this rising demand for organic food and fetch good prices, as organic foods are high priced as compared to chemical based conventional foods.

Organic agriculture is specifically suited to small farmers as it uses less amount of resources as compared to traditional crops. Today, the high cost of input and low value of final output has made agriculture non-remunerative in recent decades. Low investment in infrastructure like storage and distribution, irrigation systems, availability of certified seeds have also contributed to this cause. The seed varieties presently available have replaced the hardy, local varieties which were more resilient to climate events. The assured prices for only a few crops have also altered our cropping patterns towards a few resource-consuming crops and replaced the traditional local varieties of millets and other food grains. These grains were rich in micronutrients and low on carbohydrates and also hardy to pests and diseases. A renewed interest in these millets due to health and lifestyle diseases can offer exciting opportunities to small farmers who will have the potential to grow these food crops using fewer resources. If the products from these small farmers are further integrated with the markets, and value added to make diverse products, then such farmers can benefit from the larger customer base and high prices for their produce.

Small farmers can form cooperatives for the production of traditional foods organically, and different clusters can be formed based upon the foods that they produce. This will help in organic certification of the entire such zones, which is difficult for an individual farmer to obtain esp if the surrounding area has chemical based farms.

Organic farming is less burdensome on resources, and by offering high prices for the farm produce, it can make farming more profitable for the poor farmers and lower the poverty levels.

3.2. Environmental benefits

Green revolution brought large areas under cultivation and increased food production in developing countries. But on the downside, it led to

unsustainable use of natural resources and brought inequitable growth and increased inequality. Some of the unintended consequences of this highly technological production were, degradation of land, reduced natural fertility of the soils, nitrogen leaching into the water bodies (from excessive use of fertilizers); soil and nutrient erosion, depleting groundwater due to excessive use; alteration of biogeochemical cycles, and disturbing the ecological food chains. Hence, it caused imbalances between the biotic and non-biotic components of the ecosystem. Organic agriculture, on the other hand, relies on the use of organic inputs like green manure, farmyard manure, biopesticides, etc. in farming and increase the carbon content of the soil. Hence within time it improves the soil texture, help in better moisture retention due to increased organic matter in the soil, growth of soil friendly microbes eg. earthworms, less nitrogen leaching, more water penetration in the soil and hence less soil erosion, less acidity due to no use of fertilizers and less energy intensive.

As organic systems do not rely on chemical fertilizers and pesticides and have low irrigation needs, they lead to savings on energy and fewer carbon footprints per hectare of grain produced.

3.3. Health benefits

In organic farming, there is a high potential to grow traditional crop varieties with reasonably good yields. So it has the prospects to improve food security for the poor farmers. Organic farming encourages multi-cultures which works as an effective strategy in cases of frequent droughts and dryland agriculture. As it offers attractive market prices for farmers, their income also enhances, which can lead to a better and improved lifestyle and increased dietary diversity.

The quality of the food also improves which will have direct health benefits to the farmers and other market consumers. Also, the farmer will not be exposed to harmful chemicals, and hence his health will also improve.

3.4. Social benefits

As organic cultivation gives sufficient space for incorporation of local knowledge systems into farming, it builds upon sustainable ecosystems,

accesses local low-cost inputs and promotes selling to local markets. Such a mode of production will require large volumes of manure and other biological inputs for which large scale production of organic inputs will have to be taken up. This will give an impetus to small-scale local organic based industry for supplying green fertilizers, green pesticides, vermicompost, earthworms, milch animal waste, etc. and can be done by the farmers having small landholdings unviable for cultivation. Small scale farmers can organize themselves into small cooperatives and apply a cluster approach for production and marketing of their produce through farmer marketing organizations. This will help in obtaining better bargains in credit, better market access, and better prices, certification and standardization of products and increased export potential to high-value markets; which will enhance their social capital (Jouzi et al., 2017; Rice, 2001) and empower them by involving directly into decision-making systems. Increase in employment opportunities in rural areas will bring in other synergistic social and economic development like better nutrition and health indicators, more educational opportunities and more participation in democratic governance.

3.5 Challenges

The major challenge to overcome before any massive shift to organic agriculture can occur is the yield gaps which would be possibly encountered under organic cultivation. Researchers are divided, and different studies point to differing results in terms of the yield gaps under different crops. The soil would not be able to get as many nutrients as it gets under chemical fertilizers, management of pests and diseases would also be an issue, and so it will not be able to support the yield level that it currently does. This yield gap is a significant issue for food security considering the population pressures that the world now faces. It is argued that a global shift towards organic may reduce the yields by around 40 percent (Jouzi et al., 2017). Some studies like that done by Seufert et al. (2012), which analyzed other studies from around the world concluded that the yield under organic decreased by about 25 percent than that under conventional production. De Ponti et al. (2012) report that the yields are low by about 20 percent in an analysis of 362 field level studies. There are some other studies which report higher yields under organic cultivation.

Some points need to be considered while analyzing these results. Firstly, the change in yields has varied from developed to developing countries and from one crop to the other. Secondly, a shift to organic would still require new technological innovation in nutrient management, development of new crop varieties suitable to an organic mode of production. The current crop varieties developed post green revolution have been giving high yields only in conventional chemical-based heavy input systems (Murphy et al., 2007; van Bueren et al., 2011).

Another challenge before organic farming is the lack of access to organic manure for small scale farmers. Organic manure and fertilizer production also competes against the demand for feed for the cattle where grazing lands are scarce and feeding the livestock in dry seasons is an issue. During the initial transition shift from conventional to organic cultivation, the drop in crop productivity may not be able to sustain the subsistence farmer.
Certification of organic products is not very easy for small farmers, which is essential if they have to compete in markets of developed countries. The procedural hurdles, delays, cost constraints and standards of quality required may not be feasible for the small farmers. Besides, it may be difficult for them to export such products to developed countries as they lack specialized skills to do so, and selling such products to local markets may not be possible due to the nonexistence of such customer base and demand.

4. Organic Farming experiments in India

India has a large base of small scale farmers and climate change stressors have started affected these vulnerable groups of people in recent years. There have been changes in the rainfall patterns and frequent droughts over the years which has caused yield fluctuations, distress in prices and agrarian crisis. The subsequent reforms in fertilizer subsidy, non availability of seeds and credit on time, rising cost of fuel and no investment in infrastructure have all deepened the agrarian crisis for the Indian farmer. Organic agriculture, with its less input intensive nature and premium prices for the end product offer new opportunities for the small resource-poor farmer. Awareness on production and consumption of organic produce in India is slowly gaining momentum with the rise in incomes and a demand for

healthier food products. Some studies estimate around 5 lakh hectares to be under organic cultivation, which is about 0.3 percent of the total land under agriculture in India (

4.1. The Sikkim experiment

Sikkim was the first state to go organic entirely in 2003 and the only state to do so far. It won the Food and Agriculture Organisation's 'oscar for best policies award' in 2018 (FAO, 2018) for its efforts towards sustainable food systems.

Sikkim had certain historical advantages which aided in this transformation. Firstly, the wave of the green revolution did not touch upon the north-eastern states much. So historically, farmers had been practicing low input driven traditional forms of agriculture, which was mostly rain-fed irrigation in the absence of irrigation facilities and integrated approach to the farming system (Rao B.S., 2017). Farming in Sikkim was 'near organic' so full convertibility to organic was capitalized on it (Avasthe et al., 2014). Cereal crops grown are maize, rice and buckwheat; soybean, mustard for oil seeds; black gram and rice bean in pulses; and spices like ginger, cardamom, turmeric pepper; vegetables like tomato, peas, potato, orange and pear amongst fruits.

The government had introduced many programs and support architecture for the conversion of the state to an entirely organic state. This was achieved in several stages and steps initiated by the government. The government started campaigns like that undertaken by the State Department of Agriculture and Horticulture in 2009 supporting farmers to adopt organic cultivation. A nodal agency of 'Sikkim Organic Mission' was created in 2010 to implement the program on a mission mode. This agency along with State Cooperative Supply and Marketing Federation Ltd (SIMFED) provided market support to the farmers by procurement operations. The target to convert 50000 hectares land into organic by 2015 was adopted. Certification programs (by APEDA accredited agencies), awareness through training, incentive structures for the shift to organics, on-farm production of inputs for farming and market linkages with branding and market positioning was taken up.

4.1.1.Problems faced by the farmers

Studies (Rao B.S., 2017; Chettri, 2015) analysing the performance of organic farming in Sikkim have made the following observations:

- Though the use of chemical fertilizers was made a punishable offense, a parallel architecture supplying organic inputs (vermicompost, organic manure crops, green pesticides) was not set up by the government.
- Rainwater harvesting devices supplied by the government (e.g., storage tanks, pipelines), are rudimentary and need to be improvised.
- Assured irrigation facilities have not been made available to the farmers.
- Dairy is an essential part of organic cultivation to provide a continuous supply of farmyard manure, but the government did not encourage dairy development.
- Organic and bio-pesticides, green manure crops were not given importance
- Lack of storage processing, certification, and marketing agencies

4.2.Karnataka - Zero budget natural farming

Zero Budget Natural Farming (ZBNF) was a farming system movement started in the southern states by Subhash Palekar after years of research in farming on his family farm. Today the movement has spread to the states of Karnataka, Maharashtra, Andhra, and Kerela. It is called zero budget since it does not use farming inputs from outside and hence the need for credit. It uses biological or organic inputs from the farm of the farmer itself for use in farming as fertilizers, pesticides, etc. in recent years farmers' debt and suicides have become the primary cause of the agrarian crisis in India, and rising cost of input and hence non-remuneration in farming is discouraging the farmers from continuing it. Thus this movement offers new hope to the small farmer who cannot afford the input. The system relies on four pillars (Babu, 2008):

Jivamrutha - is made up of cow dung, cow urine, and pulse flour which then ferments into a strong microbial culture and increases the soil microbes and earthworm activity.

Beejamrutha - made up of cow urine and dung is a fungicide and anti-bacterial agent which prevents the seed and young plant root from diseases.

Acchdana (Mulching) - three types of mulching is done here. The system does not require deep ploughing and relies on soil mulching. Straw mulch made up of crop waste, or even dead animals are used. Lastly, live mulch is done by intercropping with leguminous plants which provides the nutrients to the soil.

Whapas (Water Vapour) - this system does not require lots of water and discourages heavy irrigation. Instead, water vapors are made available to the plant by irrigating in alternate furrows at noon.

While limited studies have reported the reduction in input cost by shifting to ZBNF system, only a few systematic studies studied the changes in yield. But some news reports from the ground directly from farmers claim higher yields. In a survey in Karnataka (Babu, 2008) on small and marginal farmers, it was reported that the cost of cultivation for the farmer reduced under ZBNF and there was high adaptability of the practices due to its simplicity and use of indigenous knowledge.

A study by La Via Campesina in 2016 reports that ZBNF brings socio-economic benefits to the farmers. The ecological health of the soil, yield, soil conservation, food autonomy, etc. all show improvement. Also, farmers reported reduced dependence on credit for agricultural operations.
Khadse et al. in 2017 also evaluated 97 farmers practicing ZBNF on different indicators and found positive effects of ZBNF on the overall agro-ecological system. The results are summarized in the table below.

Table 1. The efficiency of ZBNF as reported by the farmers on socio-economic and ecological indicators. (Khadse, 2017)

No. of farmers (%)	Yield	Soil Conservation	Seed Diversity	Pest Attacks	Quality of Produce	Seed Autonomy	Household Food Autonomy	Selling Price	Income	Production Cost	Need for Credit	Health
Has Decreased	12.8	2.1	12.8	84.1	4.4	2.4	4.9	7.9	7.9	4.8	90.9	0
No Change	8.5	4.3	10.3	4.5	4.4	4.9	7.3	34.2	9.5	2.3	3.8	0
Has Increased	78.7	93.6	76.9	11.4	91.1	92.7	87.8	57.9	85.7	6.8	3.8	100.0

But more studies are required to test the yield increases experienced in ZBNF system, and also the problems in the transition period when the productivity may suffer some decline.

Conclusion and Discussion

India is home to 86 percent small farmers with uneconomical holdings; these farmers do not have sufficient marketable surplus to sustain their own living. In fact, they are the net food buyers of food and make large market purchases of food. Even for the farmers who have sufficient marketable surplus, their selling of this surplus in the market depends upon the purchase operations done by the various state and central agencies like FCI (Food Corporation of India). But all states have not been covered under such purchase operations, and there are imperfect markets. At the national level, the government procures on 6 percent of the grains. Most of the time, during bumper harvest, the farmers are forced to sell the produce at meager prices and hence distress sales. But since these farmers had been practicing conventional chemical farming, so the input cost far exceeds the farm gate prices that these farmers get for selling their produce in the markets. Yields from HYVs rely on heavy irrigation, and in the absence of such facilities, these varieties do not perform well. The current scenario becomes more uncertain and increases the stress for these small farmers since the changes in climate and rainfall patterns are likely to reduce the yields from these crop varieties further. Also, the green revolution architecture shifted the cropping

patterns to a few crops led to monocultures (esp wheat and rice in India) and neglected the nutritious and locally acclimatized traditional millets. These required fewer inputs and were less susceptible to diseases and pests whereas the HYVs of wheat and rice need more input per acre and are more sensitive to climate stressors than their traditional coarser counterparts.

So for the small farmers (which are mainly subsistence farmers), organic based alternative farming systems may offer better solutions.

There is a need to conduct more research on these technologies and offer cost reducing innovative solutions. Also, we would require more research on crop varieties which are more suitable to the new mode of production and respond better to organic inputs. We would also need to revamp our training and extension system so that they can provide cost-effective solutions to the farmer as well as support on the marketing of the produce. The government support in this regard would be the most important one by policy support in favor of organic. Buy-back arrangements, storage architecture, seed banks, value addition and encouraging export of organic produce to higher-end markets and parallel creation of local markets where organic products could be sold by the farmers at premium prices would be required. This would need focussed efforts keeping the small farmer in the center of the policy-making, to make him self sufficient in terms of food security, food sovereignty, and farm ecology and climate change resilience.

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